Removal of nitrate ions from natural water by nanofiltration

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Pollution of water with nitrates is a global problem. The aim of this work was to study the basic regularities of nanofiltration removal of nitrate ions both from model aqueous solutions and real natural waters.

Experiments were conducted by means of a laboratory nanofiltration membrane cell equipped with OPMN-P and OFAM ("Vladypor", Russia) membranes. The membranes area in the cell was 38.5 cm^2. The operating pressure was created by compressed nitrogen. The experiments were carried out with model solutions of nitrate ion with concentration of 50 mg/l. KNO_3 and $Ca(NO_3)_2 \cdot 4H_2O$ salts were used to prepare the solutions. A separate set of experiments was performed with natural water. The concentration of nitrate ions in the samples was determined by nitratoanalyzer pX - 150.1. pH values of the solutions were adjusted by means of NaOH and H_2SO_4.

It was found that the nitrate retention with OPMN-P membrane appeared to be the highest in alkaline medium. This fact can be explained by the electrochemical mechanism of membrane separation. The nitrate retention decreases with an increase in a degree of the permeate selection. This was caused by the concentrating of a feed solution, which resulted in the enhanced concentration polarization effect [1].

The retention of nitrate ions with OFAM membrane was the highest in a neutral solution. Apparently this happened because the OFAM membrane had a higher ξ-potential comparing with OPMN-P membrane.

The addition of a cationic polyelectrolyte such as polydialildymetylamonium chloride in a nitrate-containing solution did not lead to an increase in nitrate retention.

It was established that while water purification from nitrate ions in neutral medium the OFAM membrane had a maximal nitrate retention of 73.2 %, while the retention for OPMN-P membrane was 42.9 %. In the acidic medium the retention of nitrate ions with the OPMN-P membrane reached 60.1 %, while for OFAM membrane it was 45.7 %. In alkaline medium the maximal retention of nitrate ions with OPMN-P and OFAM membranes was 77.1 % and 71.3 %, respectively.

References

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